

Management Recommendations for

***Pilophorus nigricaulis* Sato**

version 2.0

CONTENTS

SUMMARY	1
I. Natural History	2
A. Taxonomy and Nomenclature	2
B. Species Description	2
1. Morphology	2
2. Reproductive Biology	2
3. Ecological Roles	4
C. Range and Known Sites	4
D. Habitat Characteristics and Species Abundance	4
II. Current Species Situation	5
A. Why Species Is Listed Under Survey and Manage Standard and Guideline	5
B. Major Habitat and Viability Considerations	5
C. Threats to the Species	5
D. Distribution Relative to Land Allocations	6
III. Management Goal and Objectives	6
A. Management Goal for the Species	6
B. Objectives	6
IV. Habitat Management	6
A. Lessons From History	6
B. Identifying Habitat Areas for Management	6
C. Managing in Habitat Areas	6
D. Other Management Issues and Considerations	7
V. Research, Inventory, and Monitoring Needs	7
A. Data Gaps and Information Needs	7
B. Research Questions	7
C. Monitoring Needs and Recommendations	8
REFERENCES	9

SUMMARY

Species: *Pilophorus nigricaulis* Sato

Taxonomic Group: Lichens (Rare Rock)

ROD Components: 1, 3

Other Management Status: Oregon Natural Heritage Program List 2 (threatened with extirpation or presumed to be extirpated from the State of Oregon); Natural Heritage Network Ranks: Oregon State Rank S2 (imperiled because of rarity or because other factors demonstrably make it very vulnerable to extinction (extirpation), typically with 6-20 occurrences); Global Rank G4 (not rare and apparently secure, but with cause for long-term concern, usually with more than 100 occurrences) (Oregon Natural Heritage Program 1998). BLM Bureau Assessment Status in Oregon (USDI, BLM 1998).

Range: *Pilophorus nigricaulis* is rare throughout its range, known only from Japan and the west coast of North America, from Alaska south to Washington and Oregon, west of the Cascade crest. It is reported from 16 sites in the range of the northern spotted owl, and reaches the southern extent of its range in northern Oregon. Most known sites are on federal lands and include the Mt. Baker-Snoqualmie, Gifford Pinchot, and Willamette National Forests, Columbia River Gorge National Scenic Area and Salem District BLM.

Specific Habitat: *Pilophorus nigricaulis* grows on rock substrates from 40-1430 m (130-4700 ft) elevation, it is primarily found in non-forest communities on talus slopes, cliffs, rock outcrops, and large boulders; it may also occur on these substrates within a forest setting. Volcanic rock is the predominant substrate reported. Adjacent vegetation has been noted as old-growth forests, vine maple communities, subalpine parkland, and cryptogam-dominated communities.

Threats: The major threat to *P. nigricaulis* is loss of populations resulting from activities that affect the population or its habitat, including effects on or removing colonized substrate, altering microclimatic conditions, and collecting specimens where the species is rare. As a nitrogen-fixing species, *P. nigricaulis* may be sensitive to air pollution.

Management Recommendations:

- Manage populations of the species at known sites by maintaining the ecological conditions associated with *P. nigricaulis*, including occupied substrate and associated microclimate and stand conditions.
- Restrict collection of specimens where the species is rare or of limited abundance.
- Minimize effects to substrate occupied by *P. nigricaulis*.

Information Needs:

- Determine if *P. nigricaulis* meets the criteria established for designating a species as closely associated with late-successional and old-growth forests.
- Determine distribution of populations, species abundance, and ecological requirements of *P. nigricaulis* in the area covered by the Northwest Forest Plan.

Management Recommendations for *Pilophorus nigricaulis*

I. NATURAL HISTORY

A. Taxonomy and Nomenclature

Pilophorus nigricaulis Sato was described in 1940 (Journ. Jap. Bot. 16:173). It is in the order Lecanorales, suborder Cladoniineae, family Stereocaulaceae (Tehler 1996). There are no known synonyms.

B. Species Description

1. Morphology

Pilophorus nigricaulis is a distinctive but relatively inconspicuous rock-dwelling lichen (Figure 1). It has very short stalks arising from a white crustose primary thallus; stalks are simple with a blackish core and scattered to continuous white warts or areoles, < 5 mm tall, about 1 mm diameter. Some stalks may have terminal roundish black apothecia (McCune and Geiser 1997). It can be seen from a distance as a bright white, crustose-appearing thallus growing directly over rock, contrasting with the surrounding darker lichens and bryophytes; on closer inspection, the stalks can be seen (McCune and Geiser 1997). The basal cephalodia fix atmospheric nitrogen.

Technical Description: Horizontal thallus persistent, white or light gray, granular. Granules about 2 mm high and 1 mm broad, subglobose, aggregated or scattered on the substrate. Most granules slightly peltate. Pseudopodetia pin-like, 1-6 mm high, 1 mm in diameter. Internally, the stalks are compact, composed of strongly gelatinized hyphae, colored black by the deposition of dark pigment granules. The pseudopodetia are covered by subglobose granules of the same color, morphology, and structure as the granules of the horizontal thallus. In some specimens, a few stalks are branched. Pycnidia apical on short pseudopodetia or sessile on the horizontal thallus. Conidiophores long, slightly branched with terminal sickle-shaped conidia. Apothecia terminal on mature pseudopodetia or sometimes sessile on the horizontal thallus, 1.0-2.5 mm in diameter. Apothecial margin downturned as far as the point of attachment to the stalk. Apothecia subglobose or slightly conical. No columella is present. Apothecium and pseudopodetium separated by a broad boundary texture. No pigment boundary is present. Hymenium about 180 mm high, subhymenium 120 mm. Excipulum absent. Asci eight-spored. Spores rounded when young, becoming spindle-shaped when mature, about 18 x 7 mm. Photobiont green, *Pleurococcus* type. Cephalodia on the horizontal thallus, thick, brown to black, with wrinkled surface, about 0.5 mm in diameter, containing the cyanobacterium *Stigonema* (Jahns 1981).

2. Reproductive Biology

Pilophorus nigricaulis reproduces sexually by producing ascospores in apothecia.

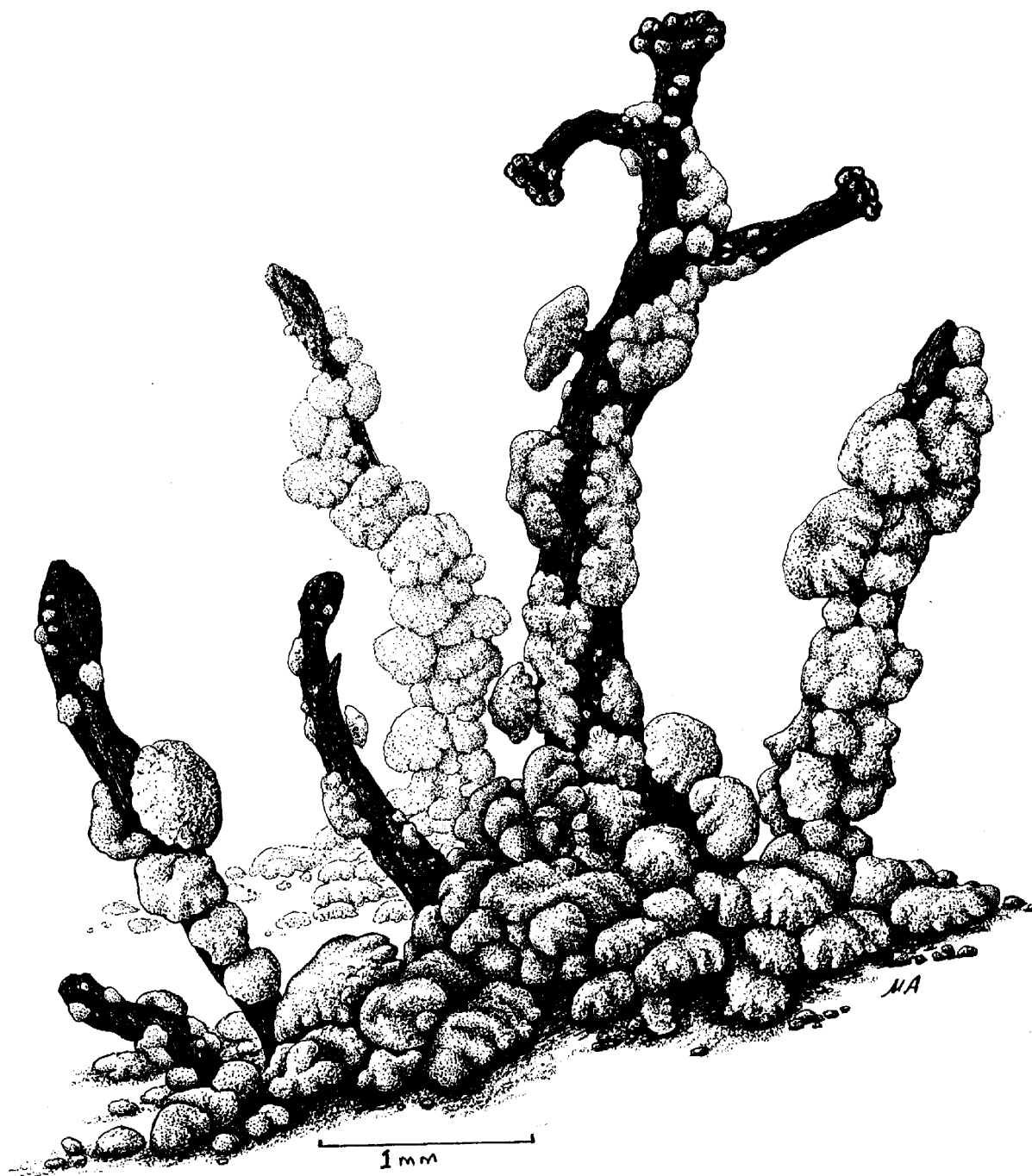


Figure 1. Line drawing of *Pilophorus nigricaulis* by Alexander Mikulin.

3. Ecological Roles

Very little is known about the ecological role of *P. nigricaulis*. This species contains cyanobacteria, so it is able to fix atmospheric nitrogen.

C. Range and Known Sites

Pilophorus nigricaulis occurs in Japan and on the west coast of North America, from Alaska south to British Columbia, Washington, and Oregon, west of the Cascade crest (Jahns 1981). Within the range of the northern spotted owl, this species has been reported from 16 sites, seven in Washington and nine in Oregon. All but one of the reported sites is on federal land. In Washington, the species is reported from Whatcom, King, Lewis and Skamania counties and, in Oregon, from Multnomah, Hood River, Marion, Linn, and Lincoln counties. On the Mt. Baker-Snoqualmie National Forest, it is reported from three sites: Austin Pass in the Mt. Baker area, Sulphur Creek Lava Flow, and Franklin Falls near Snoqualmie Pass. The taxonomic identity needs to be verified at the Sulphur Creek Lava Flow site. Four sites are reported on the Gifford Pinchot National Forest: Cowlitz Valley Ranger District on Forest Road 74 near milepost 22, the Mineral Block, Lava Cast Wayside on the south side of Mt. St. Helens, and a Current Vegetation Survey (CVS) plot (Geiser, pers. comm.). In Oregon, it is known from several sites in the Columbia River Gorge National Scenic Area: east of Multnomah Falls, on the Gorge Trail 400 east of McCord Creek, on Gorge trail 400 west of Wyeth, Eagle Creek trail, and Herman Creek Trail 406 to the Pacific Crest Trail. It is also found near Opal Creek on the Willamette National Forest, and from two sites on Salem District BLM: Carolyn's Crown Proposed Research Natural Area near Crabtree Lake, and Shaffer Creek Research Natural Area/Area of Critical Environmental Concern.

D. Habitat Characteristics and Species Abundance

Pilophorus nigricaulis grows primarily on volcanic rock substrates (basalt and andesite). Habitats have been described as lava flows, cliffs, rock outcrops, talus slopes, and large boulders. Observations of known site habitats in the Columbia River Gorge report fairly stable substrate conditions. The elevation ranges from 40 m to 1430 m (130-4700 ft). This lichen grows on rock substrates in a variety of plant communities, including low- to mid-elevation old-growth conifer forests dominated by Douglas-fir (*Pseudotsuga menziesii*), true fir (*Abies* spp.) and western hemlock (*Tsuga heterophylla*), shrub communities dominated by vine maple (*Acer circinatum*), subalpine parkland, or in open sites on rock associated with other cryptogams--such as *Cladonia*, *Stereocaulon* and *Racomitrium*.

Pilophorus nigricaulis is reported as rare throughout its range. However, several populations in the Columbia River Gorge are reported to have large colonies consisting of several hundred individuals (Davis, pers. comm.).

II. CURRENT SPECIES SITUATION

A. Why Species Is Listed Under Survey and Manage Standard and Guideline

Pilophorus nigricaulis was considered at risk under the Northwest Forest Plan because of its presumed rarity and limited distribution within the range of the northern spotted owl (USDA and USDI 1994a, 1994b). This species is sporadically distributed throughout the region and may be rare at some sites. At the time of the lichen viability panel, *P. nigricaulis* was known from 2 sites in Oregon and three in Washington (USDA and USDI 1994a, 1994b). Concern for persistence was noted for lichens in general because of their sensitivity to air pollution, however the pollution sensitivity of *P. nigricaulis* is not known. The concern for *P. nigricaulis* may increase if this species is found to be sensitive to air pollution. *Pilophorus nigricaulis* was listed under the Survey and Manage strategies 1 and 3 to manage known sites and to conduct extensive surveys to identify high priority sites for management (USDA and USDI 1994c).

B. Major Habitat and Viability Considerations

The major viability consideration for *P. nigricaulis* is loss of populations resulting from management activities that affect the populations or the habitat. A major consideration would be quarrying or road building that directly affects the colonized rock substrates. Current information suggests this species is not restricted to and may not be closely associated with late-successional and old-growth forests. Many sites are in areas where timber harvest is presently not a threat, that is, areas withdrawn from the commercial timber base or non-forested sites. Some known sites indicate habitat as rock substrates in an old-growth forest matrix, however. Removing forest canopy and subsequent changes in microclimate may affect *P. nigricaulis* in these places. A warming climate may stress populations at the limits of a species range and could result in a decline in vigor and a more restricted distribution of *P. nigricaulis*. Many of the known sites are in the Columbia River Gorge and may be more susceptible to air pollution effects, given the vicinity to the Portland metropolitan area and other pollution sources.

Additional information acquired since the original viability rating of *P. nigricaulis* provides more sites than previously known. With additional surveys in suitable habitat, this species may not be as rare as previously thought. *Pilophorus nigricaulis* appears restricted in its ecological amplitude, however, and thus is limited in distribution partly because of the specificity of its habitat requirements.

C. Threats to the Species

Threats to *P. nigricaulis* are those actions that disrupt habitat conditions necessary for its survival, including treatments that destroy populations by quarrying and road building, or stand treatments that alter the microclimate. As a nitrogen-fixing species, *P. nigricaulis* may be affected by a significant deterioration of air quality. Collecting specimens may be a threat where the species is rare or of limited abundance.

D. Distribution Relative to Land Allocations

The distribution of known sites of *P. nigricaulis* relative to land allocations needs to be determined. Each administrative unit should evaluate the land allocations for known sites on lands within its jurisdiction, and share this information at the regional level.

III. MANAGEMENT GOAL AND OBJECTIVES

A. Management Goal for the Species

The goal for managing *Pilophorus nigricaulis* is to assist in maintaining species viability.

B. Objectives

Manage known sites on federal lands by maintaining habitat, stand structure, occupied and potential suitable substrate, and microclimatic conditions associated with *Pilophorus nigricaulis*.

IV. HABITAT MANAGEMENT

A. Lessons From History

Very little is known about the ecology of this species, or how past actions have affected its distribution or viability. But, many lichen species are known to be sensitive to air pollution, and lichen population declines attributed to air pollution have been documented in Europe and North America (Rao and LeBlanc 1967, Skye and Hallberg 1969, Hawksworth 1971, Ferry *et al.* 1973, Hawksworth and Rose 1976, Case 1980, Sigal and Nash 1983, Gilbert 1992). The air pollution sensitivity of *P. nigricaulis* is unknown; but it may be sensitive to pollution, as other nitrogen-fixing lichen species have been shown to be.

B. Identifying Habitat Areas for Management

All known sites of *P. nigricaulis* on federal lands administered by the Forest Service and BLM within the range of the northern spotted owl are identified as habitat areas where these management recommendations apply. A habitat area for management is defined as suitable habitat occupied by or adjacent to a known population.

C. Managing In Habitat Areas

The goal of managing in habitat areas is to maintain the habitat conditions of the local population and minimize impacts to *P. nigricaulis*.

- Determine the extent of the local population and habitat area with a field visit.
- The local population should be managed to include an area that is large enough to maintain the habitat and associated microclimate of the population.

- Maintain occupied or potentially suitable substrate within the habitat area.
- Minimize effects to substrates occupied by *P. nigricaulis*, and restrict activities such as quarrying and road building in habitat areas.
- Restrict collection of specimens where the species is rare or of limited abundance.

D. Other Management Issues and Considerations

Information from reported sites suggests that *P. nigricaulis* may not be closely associated with late-successional and old-growth forests. For a species to be appropriately listed as a Survey and Manage species, it must first meet the criteria for designating a species as closely associated with late-successional and old-growth forests (USDA and USDI 1994a [Table IV-6] and 1994b). This issue should be addressed by a regional coordinating body.

Current information suggests that *P. nigricaulis* is sporadic in its distribution, and appears to be rare. However, this rarity may be a function of limited surveys or inventories in suitable habitat. Given the apparent rarity of this species, it should be evaluated for inclusion in the agency sensitive species programs.

V. RESEARCH, INVENTORY, AND MONITORING NEEDS

The objective of this section is to identify opportunities to acquire additional information which could contribute to more effective species management. The content of this section has not been prioritized or reviewed as to how important the particular items are for species management. The inventory, research, and monitoring identified below are not required. These recommendations should be addressed by a regional coordinating body.

A. Data Gaps and Information Needs

- Determine if *P. nigricaulis* is closely associated with late-successional and old-growth forests following the criteria established in the FEMAT report.
- Revisit known sites to verify the status of known populations, determine the extent of the populations and abundance, and characterize ecological conditions.
- Verify the taxonomic identity of the population reported from the Sulphur Creek Lava Flow on the Mt. Baker-Snoqualmie National Forest.
- Determine the distribution of *P. nigricaulis* in areas identified as potentially suitable habitat.

B. Research Questions

- What habitat characteristics and ecological conditions are necessary for the establishment of *P. nigricaulis* propagules and the survival of established thalli?
- What are the dispersal mechanisms and dispersal distances of *P. nigricaulis*?
- What is the genetic diversity of this species within its local populations and across the region?
- Is *P. nigricaulis* sensitive to air pollution?

C. Monitoring Needs and Recommendations

- If management treatments occur near known sites, monitor populations to determine their response to treatment and effects on the local population.

REFERENCES

- Case, J.W. 1980. The influence of three sour gas processing plants on the ecological distribution of epiphytic lichens in the vicinity of Fox Creek and Whitecourt, Alberta, Canada. *Water, Air and Soil Pollution* 14:45-68.
- Davis, J. 1996. Personal communication. US Fish and Wildlife Service, Portland, OR.
- Ferry, B.W., M.S. Baddeley and D.L. Hawksworth. 1973. *Air Pollution and Lichens*. University of Toronto Press. Toronto.
- Geiser, L. 1998. Personal communication. Siuslaw National Forest, Corvallis, OR.
- Gilbert, O.L. 1992. Lichen reinvasion with declining pollution. pp. 159-177. *In*: Bates, J.W. and A.M. Farmer (eds.). *Bryophytes and Lichens in a Changing Environment*. Clarendon Press, Oxford, UK.
- Hawksworth, D. L. 1971. Lichens as a litmus for air pollution: a historical review. *International Journal of Environmental Studies* 1:281-296.
- Hawksworth, D.L. and F. Rose. 1976. *Lichens as pollution monitors*. The Institute of Biology's Studies in Biology no. 66. Edward Arnold, London.
- Jahns, H.M. 1981. The genus *Pilophorus*. *Mycotaxon* 13:289-330.
- McCaffrey, C. 1996. Oregon State BLM Office, Portland, OR. Personal communication.
- McCune, B. and L. Geiser. 1997. *Macrolichens of Pacific Northwest Forests*. Oregon State University Press, Corvallis, OR. 386 p.
- Oregon Natural Heritage Program. 1998. *Rare, threatened and endangered species of Oregon*. Oregon Natural Heritage Program, Portland, OR. 92 p.
- Rao, D.N. and F. LeBlanc. 1967. Influence of an iron-sintering plant on corticolous epiphytes in Wawa, Ontario. *Bryologist* 70(2):141-157.
- Sigal, L.L. and T.H. Nash III. 1983. Lichen communities on conifers in southern California Mountains: an ecological survey relative to oxidant air pollution. *Ecology* 64(6):1343-1354.
- Skye, E. and I. Hallberg. 1969. Changes in the lichen flora following air pollution. *Oikos* 20:547-552.
- Tehler, A. 1996. Systematics, phylogeny and classification. pp. 217-239. *In*: Nash, T. H. III, (ed.). *Lichen Biology*. Cambridge University Press, Cambridge, UK.
- USDA Forest Service and USDI Bureau of Land Management. 1994a. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Related Species within the Range of the Northern Spotted Owl, Appendix A, Forest Ecosystem Management: An Ecological, Economic, and Social Assessment. Portland, OR
- USDA Forest Service and USDI Bureau of Land Management. 1994b. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-growth Forest Related Species Within the Range of the Northern Spotted Owl, Appendix J2: Results of Additional Species Analysis. Portland, OR. 476 p.
- USDA Forest Service and USDI Bureau of Land Management. 1994c. Record of decision for amendments to Forest Service and Bureau of Land Management planning documents and standards and guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Portland, OR.
- USDI, Bureau of Land Management. 1998. Bureau Special Status Species Policy (6840) and Oregon/Washington Special Status Species List, Internal Memorandum OR-98-342, August 28, 1998, including attachments.